THE RELATION BETWEEN CERTAIN PHASES OF READING ABILITY AND SPEED AND ACCURACY IN TYPEWRITING

BY

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CHAPTER I

INTRODUCTION

> The best interests of the individual, as well as of society, require selection of desirable candidates for occupational training for specialized work at various job and educational levels.[1]

The above quotation is a statement of one of the principles of Business Education as formulated by a group of leaders in the field. The principle specifies the selection of desirable candidates for "occupational training." Typewriting as a subject to be taught is justified in part on the basis of the occupational training which it offers, whether it is used as a "major activity,"[2] whether it is used to supplement other vocational activities, or whether "pupils who take such work, by virtue of their training, are able to secure related positions."[3]

Assuming a knowledge of the degree of typewriting skill required, and this may vary with the use to which it is put and with the performance required on a particular job, the question then arises as to whether pupils desiring to learn typewriting for use as a vocational tool will be able to develop sufficient skill to meet occupational requirements.

Williamson advocates exercising as much care in the selection of pupils for business courses as for any other curriculum on the ground that:

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[1]National Business Teachers Association, The Principles of Business Education, Eighth Yearbook (Bowling Green, Kentucky: The Association, 1942), p. 112.

[2]E. G. Blackstone, Improvement of Instruction in Typewriting (New York: Prentice-Hall, Inc., 1937), p. 16.

[3]A Suggested Twelve Year Program for the North Carolina Public Schools, Publication No. 235 (Raleigh, North Carolina: Issued by the State Superintendent of Public Instruction, 1942), p. 280.

> Otherwise, maladjusted and failing students will increase in number and Business Education will be judged ineffective.[4]

Jones[5] expresses a need for selection in order to limit the number of pupils who wish to take typewriting to the facilities available.

If a test could be found which would be of value in predicting typewriting scores, one phase of the problem of selection of pupils as a part of a guidance program or as a method of limiting enrollment in typewriting classes would be greatly simplified, and, in addition, a diagnosis of the factors involved might point the way to greater typewriting skill through remedial aids.

Various attempts to prognosticate success in typewriting, through measurement of traits assumed to be factors in potential typewriting skill, have already been made. The types of traits that have been involved in these studies have been classified by White[6] as mental traits, mental skills, motor abilities, and personal factors. Stedman[7] measured all of these types of traits by means of the Thurstone Employment Tests, Terman Group Test of Mental Ability, MacQuarrie Test of Mechanical Ability, fundamentals of arithmetic, spelling, and physical examination by school physician, and concluded that:

> In so far as vocational guidance is concerned no test was found to correlate highly enough with typing to make it possible

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[4]E. G. Williamson, "Guidance and Business Education," Business Education World, XVIII (October, 1937), p. 86.

[5]Marion Bradley Jones, "Reading Rate and Comprehension as Determining Factors in the Selection of Pupils for Junior High School Typewriting Classes," Master's Thesis, University of Southern California, 1932, p. 4.

[6]Bruce White, "Prediction of Typewriting Success," Journal of Business Education, X (April, 1935), p. 15.

[7]Melissa Branson Stedman, "A Study of the Possibility of Prognosis of School Success in Typewriting," Journal of Applied Psychology, XIII (October, 1929), p. 506.

> to tell a child whether or not it would be worth while for him to take up typing as a vocation.[8]

A few studies have been conducted using reading, one of the mental skills, in correlation with typewriting.

White[9] used the Whipple Reading Test in correlating gross reading scores and net reading scores with gross speed, per cent of error, and net speed in typewriting. The highest coefficient of correlation was found to be .41 ± .06, between reading net and typing net scores. He concluded that:

> From this study it appears that intelligence, reading skill, age, and performance on serial response motor tests are significant factors in typing achievement.[10]

Johnson[11] used the Monroe Silent Reading Test (III-I) in correlation with the mean of five Blackstone three-minute copying tests. The resulting correlation coefficients were .22 for rate, .12 for comprehension.

Jones[12] used the Stanford Reading Test, which tests paragraph meaning and word meaning, Pressey Speed of Reading Test, and typewriting tests provided by the Woodstock Typewriting Company. The conclusion arrived at in the study is:

> The results of this study did not reveal a consistent correlation between comprehension and typewriting rate of attainment, or between reading rate and typewriting rate of attainment to merit the suggestion that they be used in programming individual

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[8] Ibid., p. 514.

[9] White, op. cit., p. 16.

[10] Ibid., p. 20.

[11] As reported by Luton Ackerson in "A Correlation Analysis of Proficiency in Typing," Archives of Psychology, XIII (February, 1926), p. 6.

[12] Jones, op. cit., pp. 17-18.

> students for typewriting. Therefore, comprehension and reading rate are not recommended as determining factors in the selection of pupils for junior high school typewriting classes.[13]

Walden[14] used Test I, Parts A and B, of the Iowa Silent Reading Test for High Schools and Colleges to measure reading rate and comprehension. Reading rate and comprehension scores for boys and girls were correlated with typewriting speed measured in gross words. The findings as stated in the study are:

> Since the obtained coefficients of correlation in this study range from .13 ± .06 to .33 ± .05, it must be concluded that there is some relation between typewriting rate and reading rate and comprehension, but it is low.[15]

Fuller,[16] as part of a study to determine how a person reads for typewriting, correlated typewriting errors with gross speed and with reading ability. He found that:

> Gross errors in typewriting and percentage of errors in relation to number of words typed, when combined in partial and multiple correlations with gross typing speed and total reading scores show a small relationship with gross speed, and no relationship with reading ability.[17]

The results of the studies reviewed seem to be inconclusive; however, it seems reasonable that reading might have some relationship to typewriting, particularly at certain stages. Therefore, the present study employs different techniques and procedures from those that have been reported in determining the degree of relationship between reading and typewriting.

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[13] Ibid., p. 74.

[14] Ora Lacour Walden, "The Relationship Between Gross Typewriting Rate and Reading Rate and Comprehension," Master's Thesis, Oklahoma Agricultural and Mechanical College, 1942.

[15] Ibid., p. 24.

[16] Donald C. Fuller, "Reading for Typewriting," The Journal of Business Education, XIX (November, 1943), p. 12.

[17] Loc. cit.

Statement of Purpose

This study was undertaken to determine whether the degree of speed and accuracy which pupils attain during the first year of typewriting can be predicted by their scores in speed or comprehension in reading. The investigation involves these specific questions:

1. What is the degree of relationship between speed of reading and speed of typewriting?
2. What is the degree of relationship between speed of reading and reading errors in typewriting?
3. What is the degree of relationship between speed of reading and total errors in typewriting?
4. What is the degree of relationship between comprehension in reading and speed in typewriting?
5. What is the degree of relationship between comprehension in reading and reading errors in typewriting?
6. What is the degree of relationship between comprehension in reading and total errors in typewriting?

Subjects for the Study

The subjects for the study were 179 pupils in beginning typewriting classes in three high schools in North Carolina, hereafter designated as School 1, School 2, and School 3. In a fourth high school sixty-one pupils were given the reading tests for participation in this study, but because of later changes in the teacher personnel, the investigation was not followed through to the final testing of typewriting achievement. The schools were of different sizes, and the subjects were pupils in two classes in each of the three schools. This procedure was used in order to obtain an adequate random sampling of test scores. The sizes of the schools (indicated by the number of teachers), the length of the term, the length of the class periods in typewriting and

the number of pupils in two typewriting classes in each of the three schools are given in the following tabulation:

School	No. of Teachers	Length of Term	Length of Class Period in Typewriting	No. of Pupils
1	51	9 months	60 minutes	65
2	17	9 months	60 minutes	68
3	11	9 months	60 minutes (for 9 weeks, 51 minutes thereafter)	46
			Total	179

Reading Tests and Procedure in Scoring

The Chapman-Cook Speed of Reading Test, Form B, a copy of which appears in the Appendix, was used to measure speed and comprehension in reading. The test was administered according to the directions printed with the test. The following description of the test and merits claimed for it are given by the authors:

> Each paragraph of this test consists of thirty words. All difficult words, unusual construction forms, or material outside the experience of pupils were removed by experimentation in the process of assembly. In the second half of each paragraph one word spoils the meaning. The subject indicates his comprehension by deleting this single word. Throughout the construction care was taken to see that correct deletion called for a reading of the total paragraph; to attempt to guess the word is out of the question.[18]
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> 1. It measures the complex ability, speed of reading, for material of this degree of difficulty and nothing else.
> 2. The eye never has to be removed from the test.
> 3. The mental set for each paragraph remains constant; there is no question placed at the end of the paragraph--a question which may be read either before or after the paragraph and which may thus serve as a diverting factor.
> 4. The guessing factor is almost completely eliminated.
> 5. Comprehension is indicated by merely drawing a line.

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[18] J. Crosby Chapman and S. Cook, "The Principle of the Single Variable in a Speed of Reading Cross-out Test," Journal of Educational Research, VIII (December, 1923), pp. 393-394.

6. Absolute uniformity in scoring is possible.
7. It is easy to administer.
8. It takes but a short time to give (2 1/2 minutes).
9. It has ample directions and pre-drill material.
10. It is extremely easy to score and may be checked by the pupils themselves.
11. Eleven levels of achievement are established for a wide range of grades (IV to VIII).
12. The pre-drill, directions, norms, and test are all printed on a single page.[19]

Tinker and Patterson make the following statement regarding the reliability of the Chapman-Cook Test:

> According to Kelley, the reading tests should have a reliability of at least .40 to be used for group comparisons. The reliability of the Chapman-Cook tests far exceeds this requirement. The correlation between the paired scores for Form A and Form B for 2260 Twin City High School seniors was $+0.76 \pm 0.006$.[20]

The test provides only one score, namely speed of reading, determined on the basis of the number of paragraphs completed correctly. This method of measuring reading ability is in agreement with views held by authorities in the field to the effect that speed can not be measured independently of comprehension. Tinker says that:

> Certain writers seem to believe that speed of reading is something which can be divorced from comprehension and still remain a valid measure of reading performance. A measure of the rate with which words are recognized as words, however, with no reference to apprehension of the relationships and the meanings involved, yields a score of little or no significance in the reading situation. In other words, "reading" without comprehension is not reading. The only adequate definition of speed of reading, is to consider it rate of comprehension. To measure speed of reading, therefore, one must measure the rate with which material is comprehended. Thus, in practice, it is important to know the rate with which history text is comprehended, etc. In the reading-test situation, rate of reading is rate of comprehending as measured in the test.[21]

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[19] Ibid., p. 396.

[20] Donald G. Patterson and Miles A. Tinker, How to Make Type Readable (New York: Harper & Brothers Publishers, 1940), p. 175.

[21] Miles A. Tinker, "Dr. Robinson on Speed Versus Comprehension in Reading: A Discussion," Journal of Educational Psychology, XXXI (October, 1940), p. 559.

Tinker used two forms of the Chapman-Cook test to determine the relationship between speed (rate of work) and degree of comprehension (accuracy) in reading on strictly comparable material on the "no difficulty" level. He measured speed of reading by two methods: (1) ascertaining the total time taken to complete the test, (2) counting the number of paragraphs attempted within standard time. He concluded that "the number attempted in standard time is as good a rate measure as the time taken for the whole test. . . ."[22] Comprehension in reading was measured by the number of paragraphs completed correctly in standard time.

In typewriting there is the possibility that when typing from straight copy material, as in the testing procedures in this study, the typist may perceive visually the letters, words, phrases, or sentences to be written without any understanding of them since the "purpose that takes [him] to the printed page"[23] is to transfer the material from the copy to the paper in the typewriter. Moreover, the comprehension element may hinder, help, or be of no effect in the typewriting situation.

It was deemed advisable, therefore, to separate the two factors, speed and comprehension. The technique developed by Tinker seems to apply to this conception of visual perception, which, in this study, is called speed of reading and which Tinker calls speed or rate of work. The comprehension factor, as measured in the Chapman-Cook test, is not

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[22]Miles A. Tinker, "Speed Versus Comprehension in Reading as Affected by Level of Difficulty," The Journal of Educational Psychology, XXX (February, 1939), p. 85.

[23]William S. Gray, "Reading," in Walter S. Monroe, Editor, Encyclopedia of Educational Research (New York: The Macmillan Company, 1941). p. 906.

"'power' or level of difficulty that can be mastered. . ."[24] but the degree of accuracy or understanding of the material visually perceived.

The method of determining speed (rate of work), or rate of visual perception, and comprehension, or degree of accuracy, scores in this study is the same as that used by Tinker; i.e., the total number of paragraphs attempted is the speed score and the number of paragraphs completed correctly is the comprehension score. Both scores were obtained from one form of the test rather than from two forms as used by Tinker.

The reading tests were administered to the subjects in this study during the first semester of the school year to minimize the influence that typewriting learning might have upon reading ability.

Typewriting Tests and Procedure in Scoring

On the assumption that various stages in the learning of typewriting might show variations in the relationship of typewriting achievement with speed and comprehension in reading, the typewriting testing program included three typewriting tests at four-week intervals. A summary of the testing schedule follows:

TEST	DATE ADMINISTERED	NUMBER OF SUBJECTS			TOTAL
		School 1	School 2	School 3	
Typing 1	8th week 2nd semester	55	51	36	142
Typing 2	12th week 2nd semester	51	51	34	136
Typing 3	16th week 2nd semester	51	49	38	138

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[24] R. H. Seashore, L. B. O. Stockford, and B. K. Swartz, "A Correlation Analysis of Factors in Speed of Reading Tests," School and Society, XLVI (August, 1937), p. 188.

Absences at the time the typewriting test was given, drop-outs, and changes to other classes account for the decrease in the number of subjects from the 179 who took the reading test to 138 who took the third typewriting test.

Three International Typing Tests, Numbers 380, 381, and 382 by J. N. Kimball, copies of which appear in the Appendix, were used to measure typewriting. These tests were used in preference to other tests published for free distribution in order to obviate the possible influence of practice.

The three typewriting tests were five-minute tests on straight copy material. The validity of short tests has been established by research, as summarized by Ackerson in the following statement:

> Considerable experimental work is reported, the conclusions of which were that upon the stroke basis, the results of a three-minute test were as "regular" as those of tests of one minute, two minutes, etc., up to ten minutes. . . .[25]

According to Lessenberry and Jevon:

> The tendency seems to be to emphasize the 5-minute writing rather than the longer timed practice. The 10-minute and the 15-minute writings test endurance and control--perhaps they help to develop endurance and control. These longer tests should be used less frequently than shorter 5-minute writing.[26]

Rate: For purposes of this study, the unit of measure for speed in typewriting was gross words per minute, reckoned in accordance with the International Contest Rules for Correcting Typing Tests, a copy of which is presented in the Appendix. The total number of gross words divided by the number of minutes typed gives the rate in terms of gross words per minute.

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[25]Ackerson, op. cit., p. 5.

[26]D. D. Lessenberry and E. A. Jevon, Manual for 20th Century Typewriting (Cincinnati: South-Western Publishing Company, 1938), p. 17.

Total Errors: The typewriting test papers were scored for accuracy in terms of number of errors according to the International Rules for Correcting Typing Tests, with two minor adaptations. The length of line prescribed by International Rules (70 spaces) was not rigidly adhered to. The 70-space line is advantageous in typewriting contests but is not suitable for most learning exercises, and is not uniformly followed in classroom testing procedures. Moreover, various printings of the International Rules set the range of line limits at various marks. Since the length of line is not important in measuring typewriting speed, irregularities of line length in the test papers of this study were disregarded. The International Rules specify a paragraph indention of five spaces and penalize all deviations. In practice, however, paragraph indention may acceptably vary from that standard. On all test papers received from one class, the number of spaces allowed for paragraph indentions was three instead of five. These deviations were not penalized as errors. Variations from the three-space indentions in these papers were counted as errors.

Reading Errors: The procedure of ascertaining total errors by International Rules is a common practice in scoring typewritten material. In this study, however, in addition to checking total errors, analysis was made to isolate certain errors which may have had their source in the reading of the copy and might thus bear more direct relation to speed and comprehension than does total number of errors.

Book[27] says that reading errors are produced by not keeping the eyes and attention closely enough focused on the copy. He classifies such errors as follows:

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[27]William F. Book, Learning to Typewrite (New York: The Gregg Publishing Company, 1925), p. 265.

> . . . (1) deviations from the copy in punctuation, paragraphing, capitalization, etc.; (2) omission of words or parts of sentences; (3) the insertion or repetition of a word or phrase; (4) the substitution of a wrong word or phrase for the correct one.[28]

Dvorak et al.[29] indicate that reading for typewriting should include reading the copy for meaning, and list "copy-reading errors" as one of the "minor varieties of error."[30] They give the following explanation of copy-reading errors:

> . . . copy-reading errors result in reswitching of words. The eye motions of a usual typist are seldom more than one or two words ahead. Insertions or omissions of words then follow personal influence quite unrelated to the run of the typing.[31]

Fuller[32] points out that comprehension is not a major factor in reading for typewriting and makes the following assertion in regard to the classification of errors:

> In typewriting it is sometimes hard to differentiate reading errors from so-called mechanical errors. The pure reading errors--such as confusion of the middle of rather long words like "commission" and "communion," or "precision" and "procession"; reversal of words like "The dog saw a boy" for "The boy saw a dog," etc. are easy to distinguish. But some of the so-called mechanical errors may be due to an improper reading technique when weakened signals are given to the fingers, and would be classified as reading errors except for the difficulty in identification.[33]

The present study attempted to obtain a measure of reading that is independent of understanding. Certain errors in typewriting may be the result of visually perceiving individual letters, words, or phrases out of their proper sequence, and may show up in such variations from

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[28] Loc. cit.

[29] August Dvorak et al., Typewriting Behavior (New York: American Book Company, 1936), p. 182.

[30] Ibid., p. 397.

[31] Loc. cit.

[32] Fuller, op. cit., (October, 1943), p. 19.

[33] Ibid., (September, 1943), p. 20.

the copy as omission, insertion, or misspelling of words, rewritten matter, or transposition of words. Such variations from the copy are hereafter termed "reading errors." Where a figure is inserted for a letter in a word, the error is clearly caused by an incorrect reach, and so is not a reading error.

Treatment of Data

All test papers were returned to and checked by the investigator. Computations and markings of errors on the typewriting papers were verified by a competent typewriting teacher.

The data obtained on the various typewriting tests from each of the three schools were treated separately and as a combined total for all schools in the statistical analyses of the relationship between speed of reading and (1) gross words in typewriting, (2) reading errors in typewriting, (3) total errors in typewriting, and of the relationship between comprehension in reading and (1) gross words in typewriting, (2) reading errors in typewriting, (3) total errors in typewriting.

A total of seventy-two correlations were made. The following formula for computing the coefficient of correlation was used:[34]

$$\underline{r} = \frac{\Sigma XY - NM_XM_Y}{\sqrt{\left[\Sigma X^2 - NM^2_X\right]\left[\Sigma Y^2 - NM^2_Y\right]}}$$

The letters in the above formula are interpreted as follows: X = reading scores, Y = typewriting scores, N = number of scores, M_X = mean of reading scores, M_Y = mean of typewriting scores, Σ = summation, $\underline{r}$ = the obtained coefficient.

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[34]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Co., 1941), p. 274.

Garrett explains the coefficient of correlation as follows:

> . . . coefficients of correlation range over a scale which extends from —1.00 through .00 to 1.00.[35]

> Negative coefficients may range from —1.00 up to .00, just as positive coefficients may range from .00 up to 1.00.[36]

The following excerpt from Kramer is presented to explain the meaning of correlation:

> Correlation is high and positive if, in general, a high rank in one set of scores means a high rank in the other, and a low rank in one set means a low rank in the other; . . . High negative correlation exists if, in general, a high rank in one set of scores corresponds to a low rank in the other, and if a low rank in the first set corresponds to a high rank in the other.
>
> Correlation is low if no sort of correspondence seems to exist, if a high score in one set is just as likely to correspond to a low score in the other set as to a high score.[37]

The coefficient of correlation represents the degree of relationship between the measured factors but does not indicate that one factor causes the other. In other words, a high coefficient of correlation between reading rate and typewriting rate does not mean that reading rate causes typewriting rate or that typewriting rate causes reading rate.

The variability of a coefficient is measured by its standard error computed by the following formula:[38]

$$\sigma_r = \frac{1 - r^2}{\sqrt{N}}$$

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[35] Ibid., p. 254.

[36] Ibid., p. 253.

[37] Edna E. Kramer, A First Course in Educational Statistics (New York: John Wiley & Sons, Inc., 1935), pp. 135-136.

[38] Frederick E. Croxton and Dudley J. Cowden, Practical Business Statistics (New York: Prentice-Hall, Inc., 1938), p. 419.

The standard error takes into account the chance factors which may have caused the degree of correlation indicated by the coefficient of correlation. ". . . it is the average expected change, or error, caused by the operation of many elements which are responsible for a variation in value."[39] The ratio of the r to its standard error should yield an index of 3 or more to establish reliability.[40]

To evaluate the obtained coefficient of correlation in terms of its predictive value, the following formula for coefficient of alienation was applied:[41]

$$k = \sqrt{1 - r^2}$$

The coefficient of alienation measures the

> . . . absence of relationship between two variables X and Y in the same sense in which r measures the presence of relationship. When $k = 1.00$, $r = .00$, and when $k = .00$, $r = 1.00$, so that the larger the coefficient of alienation the smaller the degree of relation, and the less precise the prediction from X to Y.[42]

When the formula for k is applied to an r of .10, ". . . there remains 99.5 per cent of guess in prediction based on it; the prediction has been improved only one-half of 1 per cent over pure chance."[43] Statisticians hold that an r should be .90 or more in order to accurately predict Y scores from X scores.[44] When the formula for k is applied to

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[39]Carter V. Good, A. S. Barr, and Douglas E. Scates, The Methodology of Educational Research (New York: D. Appleton-Century Company, 1936), p. 610.

[40]Croxton and Cowden, op. cit., p. 420.

[41]Garrett, op. cit., p. 345.

[42]Loc. cit.

[43]Charles C. Peters and Walter R. Van Voorhis, Statistical Procedures and their Mathematical Bases (New York: Mc Graw-Hill Book Company, Inc., 1940), p. 115.

[44]Garrett, op. cit., p. 345.

an r of .90, it is found that there remains 44 per cent of guess in a prediction based on it; consequently, prediction of Y from X would be 56 per cent above guess.

All the statistical calculations in this study, with the exception of those made on a listing machine, were made twice to assure their accuracy. Machine calculations were verified by a check of listings on the tape.

This chapter has expressed the need for and purpose of this study, with a description of testing materials and statistical procedures. Chapter II will give an analysis and interpretation of obtained measures of relationship between the reading and typewriting test scores.

CHAPTER II

FINDINGS

The results of statistical treatment of the data obtained in this study are presented in Tables I-VII. Tabulations of the individual test scores from each school are presented in the Appendix.

The highest coefficient of correlation was obtained on Typewriting Test 1 in School 3, between reading speed and gross words in typewriting, but the degree of relationship was found to diminish with later tests. Table I shows this r to be .437 with a standard error of .135. This means that, based on the normal probability curve, there are 68 chances in 100 that the obtained r, .437, does not vary from the true r by more than $\pm$ .135. The true r is that r between reading speed and gross words in typewriting which the entire population from which the sample was drawn would be expected to yield.[1]

The ratio of the r to its standard error exceeds 3, the figure required for statistical significance, and is thus established as reliable. That is, the relationship is to be considered as greater than zero;[2] but when interpreted in terms of its predictive value ($k = .90$), the obtained coefficient reveals that there is 90 per cent of the element of chance in a prediction based on it.

Since the r of .437 is the highest yielded by any set of scores, and since this r interpreted in terms of k shows 90 per cent of the element of chance in predicting scores, it was apparent that none of

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[1]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Co., 1941), p. 281.

[2]Frederick E. Croxton and Dudley J. Cowden, Practical Business Statistics (New York: Prentice-Hall, Inc., 1938), p. 420.

TABLE I

COEFFICIENTS OF CORRELATION BETWEEN THE VARIOUS FACTORS OBTAINED FROM EACH SCHOOL ON THE BASIS OF EACH TYPEWRITING TEST

School	Typewriting Test 1		Typewriting Test 2		Typewriting Test 3	
	r	σ	r	σ	r	σ
Reading Speed and Gross Words in Typewriting						
1	.172	.131	.073	.139	.301	.127
2	.127	.138	.092	.139	.049	.143
3	.437	.135	.417	.142	.392	.137
Combined	.283	.077	.234	.081	.306	.077
Reading Speed and Reading Errors in Typewriting						
1	—.335	.120	—.224	.133	.070	.139
2	.084	.139	.200	.134	.016	.143
3	.048	.166	.247	.161	.267	.151
Combined	—.146	.082	.012	.086	.084	.085
Reading Speed and Total Errors in Typewriting						
1	—.358	.118	—.146	.137	.037	.140
2	.006	.140	.186	.135	—.023	.143
3	—.290	.153	.214	.164	.142	.159
Combined	—.258	.078	.025	.086	.005	.085
Reading Comprehension and Gross Words in Typewriting						
1	.105	.133	.068	.139	.274	.130
2	.130	.138	.079	.139	.037	.143
3	.414	.138	.422	.141	.374	.140
Combined	.241	.079	.224	.081	.275	.079
Reading Comprehension and Reading Errors in Typewriting						
1	—.353	.118	—.243	.132	—.030	.140
2	.117	.138	.190	.135	.013	.143
3	.079	.166	.249	.161	.236	.153
Combined	—.129	.083	.006	.086	.043	.085
Reading Comprehension and Total Errors in Typewriting						
1	—.386	.115	—.136	.137	—.123	.138
2	.055	.140	.180	.135	—.015	.143
3	—.306	.151	.227	.163	.049	.162
Combined	—.249	.079	.034	.086	—.061	.085

the measured relationships in this study was sufficiently large to be of value in predicting typewriting scores from reading scores. Therefore, the varying conditions under which the tests were given--size of school, length of class periods in typewriting, differences in teaching procedures--are not considered to affect materially the results obtained. Hence the scores from the three schools were combined as a group total to provide a greater degree of reliability. The analyses which are discussed in the remainder of this report are based on the reading scores obtained from the total group and typewriting scores obtained on the third typewriting test by the total group. The third typewriting test, given during the sixteenth week of the second semester of typewriting learning, was selected as the one measuring the pupils' achievement at the stage nearest to the time of vocational use.

Relationship of Reading to Typewriting at Various Stages of Typewriting Learning

Table I reveals that, when only the combined scores from the three schools are considered, an apparently higher relationship was found between reading speed and gross words on Typewriting Test 3 than between reading speed and gross words on either of the other two typewriting tests.

A higher positive relationship was found between reading comprehension and gross words on Typewriting Test 3 than between reading comprehension and gross words on either of the other typewriting tests.

Scores on errors, both reading and total, from Typewriting Test 1 showed a higher correlation with scores on speed and comprehension in reading than did scores on either of the other typewriting tests.

Even though there may be implied a greater relationship between typewriting achievement and speed or comprehension in reading at one

stage in the learning of typewriting than at another, the fact that no measured relationship was high enough to be of predictive value renders further investigation unimportant for purposes of this study.

Reading Speed and Gross Words in Typewriting

The coefficient of correlation between reading speed and gross words in typewriting, based on Typewriting Test 3, is the highest obtained by correlating any two of the factors measured in this study, when only the combined scores are considered. This *r* as shown by Table II was found to be .306 with a standard error of .077, which means that the chances are 68 in 100 that the true *r* lies between .229 and .383. ($r \pm 1\sigma$). The *r* of .306 is significant (3 times σ). There is a low positive relationship between reading speed and gross words in typewriting; but, interpreted in terms of *k*, it shows 95 per cent of chance in prediction. Estimates of gross words in typewriting based on scores in reading would be little better than guess. Therefore, speed of reading, as measured in this study, can not be used to predict gross words in typewriting. It would seem that the type of reading measured by the Chapman-Cook Speed of Reading Test does not call for the type of reading that takes place in typewriting.

Correlations reported in other studies between reading rate and typewriting have also been low. Johnson[3] obtained an *r* of .22, Jones[4] obtained an *r* of .245 for low ninth grade pupils and .366 for high ninth

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[3]As reported by Luton Ackerson in "A Correlation Analysis of Proficiency in Typing," Archives of Psychology, XIII (February, 1926), p. 6.

[4]Marion Bradley Jones, "Reading Rate and Comprehension as Determining Factors in the Selection of Pupils for Junior High School Typewriting Classes," Master's Thesis, University of Southern California, 1932, p. 27.

TABLE II

READING SPEED AND GROSS WORDS IN TYPEWRITING

School	No. of Subjects	r	σ
	Typewriting Test 1		
1	55	.172	.131
2	51	.127	.138
3	36	.437	.135
Combined	142	.283	.077
	Typewriting Test 2		
1	51	.073	.139
2	51	.092	.139
3	34	.417	.142
Combined	136	.234	.081
	Typewriting Test 3		
1	51	.301	.127
2	49	.049	.143
3	38	.392	.137
Combined	138	.306	.077

grade pupils, and Walden[5] obtained an r of .22±.04 based on the combined scores of boys and girls.

Reading Speed and Reading Errors in Typewriting

Table III shows the coefficient of correlation between reading speed and reading errors ascertained from the last typewriting test to be .084 with a standard error of .085. The chances are 68 in 100 that the true r will lie between —.001 and .169. The relationship between reading speed and reading errors in typewriting is negligible. A high score in reading speed is just as likely to correspond to a high score in reading errors in typewriting as a low score, and a low score in reading speed is just as likely to correspond to a high score in reading errors in typewriting as a low one.

The coefficient of alienation computed using this r of .084 is .99, showing a predictive value of less than 1 per cent over pure chance.

The number of reading errors in typewriting which a pupil will make can not be accurately predicted from reading speed scores. A program designed to increase reading speed as a means of decreasing reading errors in typewriting is not justified on the basis of this finding.

Reading Speed and Total Errors in Typewriting

The relationship between reading speed and total errors in typewriting based on 138 scores, the total number of scores from the three schools on Typewriting Test 3, is .005 with a standard error of .085 as

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[5]Ora Lacour Walden, "The Relationship Between Gross Typewriting Rate and Reading Rate and Comprehension," Master's Thesis, Oklahoma Agricultural and Mechanical College, 1942, p. 16.

TABLE III

READING SPEED AND READING ERRORS IN TYPEWRITING

School	No. of Subjects	r	σ
	Typewriting Test 1		
1	55	—.335	.120
2	51	.084	.139
3	36	.048	.166
Combined	142	—.146	.082
	Typewriting Test 2		
1	51	—.224	.133
2	51	.200	.134
3	34	.247	.161
Combined	136	.012	.086
	Typewriting Test 3		
1	51	.070	.139
2	49	.016.	.143
3	38	.267	.151
Combined	138	.084	.085

shown in Table IV. The true r obtained from the total population of which 138 cases is a sample would lie between -.080 and .090. Should the true r extend to its lowest or highest limit, the degree of relationship would be low.

The coefficient of alienation obtained on this r is approximately 1.00 and indicates that estimates of total errors in typewriting based on reading speed scores would be guesses. The r obtained between reading speed and reading errors in typewriting is only .079 greater than the r obtained between reading speed and total errors in typewriting. A separation of the two types of errors is not warranted on the basis of the findings.

This finding is in agreement with that of Fuller[6] to the effect that errors in typewriting showed no relationship with reading ability.

Reading Comprehension and Gross Words in Typewriting

Table V shows the coefficients of correlation and their standard errors between comprehension in reading and gross words in typewriting. The r based on the combined scores in the third testing stage is .275 with a standard error of .079. The chances are 68 in 100 that the r of .275 does not vary from the true r by more than $\pm$ .079. The ratio of .275 to .079 is 3.5; therefore, the r is significant.

The coefficient of alienation for this r shows that there is 96 per cent of guess in scores in gross words in typewriting based on scores in reading comprehension. In other words, scores in gross words in typewriting, attained by the sixteenth week of the second semester of

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[6]Donald C. Fuller, "Reading for Typewriting," The Journal of Business Education, XIX (November, 1943), p. 12.

TABLE IV

READING SPEED AND TOTAL ERRORS IN TYPEWRITING

School	No. of Subjects	r	σ
	Typewriting Test 1		
1	55	—.358	.118
2	51	.006	.140
3	36	—.290	.153
Combined	142	—.258	.078
	Typewriting Test 2		
1	51	—.146	.137
2	51	.186	.135
3	34	.214	.164
Combined	136	.025	.086
	Typewriting Test 3		
1	51	.037	.140
2	49	—.023	.143
3	38	.142	.159
Combined	138	.005	.085

TABLE V

READING COMPREHENSION AND GROSS WORDS IN TYPEWRITING

School	No. of Subjects	r	σ
	Typewriting Test 1		
1	55	.105	.133
2	51	.130	.138
3	36	.414	.138
Combined	142	.241	.079
	Typewriting Test 2		
1	51	.068	.139
2	51	.079	.139
3	34	.422	.141
Combined	136	.224	.081
	Typewriting Test 3		
1	51	.274	.130
2	49	.037	.143
3	38	.374	.140
Combined	138	.275	.079

instruction, can not be predicted from reading comprehension scores with more than 4 per cent accuracy.

The r obtained between reading comprehension and gross words in typewriting is .031 less than the r obtained between reading speed and typewriting gross words. Reading speed and reading comprehension, as measured in this study, in correlation with gross words in typewriting yield approximately the same results. Both show a low positive relationship which is not great enough to be used as a basis of selection of pupils for typewriting classes.

Johnson[7] obtained an r between reading comprehension and typewriting rate of .12. This was .10 less than the r for reading rate. In the study by Jones,[8] the coefficients of correlation obtained between comprehension and typewriting rate were .122 and .529 for the low and high ninth grade pupils respectively. These coefficients were .123 smaller than those between reading rate and typewriting rate for the low ninth grade pupils and .163 greater than those for the high ninth grade pupils. Walden[9] obtained an r of .26 ± .04 between typewriting rate and reading comprehension for boys and girls combined. This is .04 more than the correlation shown between reading rate and typewriting rate.

Reading Comprehension and Reading Errors in Typewriting

Table VI gives the coefficients of correlation between comprehension in reading and reading errors in typewriting. The r for the

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[7]As reported by Luton Ackerson, op. cit., p. 6.

[8]Jones, op. cit., p. 53.

[9]Walden, op. cit., p. 20.

TABLE VI

READING COMPREHENSION AND READING ERRORS IN TYPEWRITING

School	No. of Subjects	r	σ
	Typewriting Test 1		
1	55	—.353	.118
2	51	.117	.138
3	36	.079	.166
Combined	142	—.129	.083
	Typewriting Test 2		
1	51	—.243	.132
2	51	.190	.135
3	34	.249	.161
Combined	136	.006	.086
	Typewriting Test 3		
1	51	—.030	.140
2	49	.013	.143
3	38	.236	.153
Combined	138	.043	.085

combined scores on Typewriting Test 3 is .043 with a standard error of .085. The chances are 68 in 100 that the true r lies within the limits —.042 and .128. The relationship between reading comprehension and reading errors is negligible.

The coefficient of alienation for the r of .043 is .99, indicating a predictive value of less than 1 per cent above chance. A knowledge of reading comprehension is of practically no value in estimating reading errors in typewriting.

Reading rate correlated with reading errors in typewriting shows approximately the same relationship as reading comprehension correlated with reading errors in typewriting. The difference is .041 greater between reading rate and reading errors in typewriting.

Reading Comprehension and Total Errors in Typewriting

In Table VII the coefficients of correlation and their standard errors between comprehension in reading and total errors in typewriting are given. The r for the combined scores from Typewriting Test 3 is —.061 with a standard error of .085. There are 68 chances in 100 that the true r lies between —.146 and .024. The relationship between reading comprehension and total errors in typewriting is negligible. The pupil who comprehends to a high degree is just as likely to make a large number of errors in typewriting as a small number of errors.

The coefficient of alienation of .99 for the combined scores in Typewriting Test 3 indicates that the knowledge of a pupil's reading comprehension is of practically no value in estimating the total number of errors he will make in typewriting.

Chapter III will give a summary of the study and conclusions based on the findings reported in this chapter.

TABLE VII

READING COMPREHENSION AND TOTAL ERRORS IN TYPEWRITING

School	No. of Subjects	r	σ
	Typewriting Test 1		
1	55	—.386	.115
2	51	.055	.140
3	36	—.306	.151
Combined	142	—.249	.079
	Typewriting Test 2		
1	51	—.136	.137
2	51	.180	.135
3	34	.227	.163
Combined	136	.034	.086
	Typewriting Test 3		
1	51	—.123	.138
2	49	—.015	.143
3	38	.049	.162
Combined	138	—.061	.085

CHAPTER III

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine whether the speed and accuracy which pupils attain during the first year of typewriting can be predicted by their scores in speed and comprehension in reading.

The subjects for the study were 179 pupils in two beginning typewriting classes in each of three North Carolina high schools during the school year 1942-1943. The Chapman-Cook Speed of Reading Test was used to measure speed and comprehension in reading and was administered to the subjects during the first semester of the school year. Three straight copy typewriting tests by J. N. Kimball were used to measure gross words, reading errors, and total errors in typewriting and were administered to the subjects at intervals of four weeks beginning with the eighth week of the second semester. Of the 179 initially selected subjects, 142 took Typewriting Test 1, 136 took Typewriting Test 2, and 138 took Typewriting Test 3.

Preliminary statistical treatment of the data revealed no coefficient of correlation sufficiently high to be of predictive value, either on the basis of separate school groups or for the combined total group.

Correlations were computed between reading speed and (1) gross words,(2) reading errors, and (3) total errors in typewriting, and between reading comprehension and (1) gross words, (2) reading errors, and (3) total errors in typewriting. The resulting coefficients were interpreted in terms of their predictive value by obtaining the coefficient of alienation.

The highest coefficient of correlation obtained in this study is

.437 with a standard error of .135, for reading speed and gross words in typewriting. Since the predictive value of this r is only 10 per cent above chance, it must be concluded that scores in reading rate and comprehension, as measured in this study, can not be used to predict typewriting ability as measured by gross words, reading errors, and total errors. The coefficients found for the various other correlations ranged from—.386 through .005 to .422.

On the basis of these findings, it is not recommended that selection of pupils for typewriting classes be based on reading ability.

Although slight variations were found in the degree of relationship between reading and typewriting at various stages of the learning of typewriting, the measured relationship at any one of the three stages was not great enough to be of value in predicting typewriting ability.

Gross words in typewriting correlated with reading speed or comprehension showed a low positive relationship between the measures, indicating that reading should not be ruled out altogether as a factor in typewriting ability. Reading ability combined with other factors considered to be elements in typewriting ability may prove to be an effective basis for prognosis.

When errors in typewriting, either reading or total, were correlated with speed or comprehension in reading, the results showed a negligible relationship between the sets of scores. Errors in typewriting ascertained by some method which would take into consideration the probable causes of the errors might show a greater relationship to reading ability than errors ascertained by the International Rules for Correcting Typing Tests.

The findings seem to indicate that the reading called for in the typewriting situation is not the same as that measured by the reading

test used in this study. A study of how a person reads for typewriting should point the way to the type of reading test which might be of greater predictive value.

The findings in this study are in agreement with the findings in related studies.

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APPENDIX

CHAPMAN-COOK SPEED OF READING TEST

Form B

NAME ..... BOY or GIRL .....
Last First Middle

CITY ..... GRADE .....

DATE 19 ..... TEACHER .....
Year Month Day

DATE of BIRTH 19 ..... SCHOOL .....
Year Month Day

AGE ..... SCORED BY .....
Years Months

Score .....

PRELIMINARY DRILL

In the second half of each of the following sentences, **one word** spoils the meaning of the paragraph. Find this word as quickly as you can, and cross it out. You must not write anything. Cross out the word that should not be there. In the first paragraph you can see that the word "thinnest" does not fit in with the meaning of the rest of the paragraph. You will therefore take your pencil and draw a line through the word. In the second paragraph, "nail" is wrong; you must, therefore, cross it out.

X. It was such a cold, boisterous, and wintry day that every person who was walking wore the thinnest clothes that he could find in his clothes-closet at the time.

Y. There was a fire last night, and five houses were burned to the ground. It all happened because someone was careless, and threw a nail into the waste-paper basket.

Now cross out the one word which should not be there in the six paragraphs below. After you have done them, the teacher will go over them orally to be sure that you understand.

A. There was not a drop of ink in the house, for someone had broken the bottle we kept it in, so Mary decided to finish her letter with a pen.

B. Yesterday I went down town to buy some shoes and rubbers, but, when I got home, I found I had forgotten to go to the flower-store to get them.

C. The water had frozen, making the road as slippery as glass. It was only with the greatest difficulty that I prevented myself from fighting as I made my way home.

D. I was not in time for school, because I played marbles on the way; so the teacher sent a note to my parents, saying I had been early that morning.

E. One of the boys was extremely rude to the teacher so she made him come and stand by her desk, to show that he had been a very good boy.

F. When I am enjoying anything very much, time seems to go very quickly. I noticed this the other day, when I spent the whole afternoon reading a very uninteresting book.

On the other side of this sheet, there are thirty paragraphs like the ones you have done. When you are given the signal, and not before, turn the sheet over, and cross out in the **second** part of each paragraph, the **one** word which should not be there. Ask no questions. Do not stay too long on any one paragraph, but go on to the next. Remember you do no writing; you merely cross out the **one word** in the second part of the paragraph.

This is a test for speed and accuracy. Be sure to work as fast as you can, and yet not make mistakes.

Published by
EDUCATIONAL TEST BUREAU
EDUCATIONAL PUBLISHERS, Inc.
Minneapolis - Nashville - Philadelphia

Cross out, in the second part of each paragraph, the one word which spoils the meaning. (2½ minutes allowed.)

1. Mary was sitting on the seashore one hot day in June. She said to her mother, "If only I had brought my skates along, I could have had great fun."

2. The house was brightly lit and a merry and happy party was going on. The passers-by knew this for they could plainly hear many people weeping in the house.

3. This morning my mother asked me to find out what time it was. I therefore ran just as rapidly as I could to look at the calendar on the wall.

4. Mary is only five years old, and yet her eyes are troubling her a great deal. It seems dreadful to be compelled to use crutches at so young an age.

5. The visitors were not expected and as the pantry was empty there was nothing to do but to tell them they would have to go home without getting any money.

6. Mr. Smith gave a newsboy a quarter for a paper and left without his change. When the boy ran and told him he said he had never seen such dishonesty.

7. It was a cold day in winter and the ground was covered with deep snow. The children thought it just the day to go swimming for the sun was bright.

8. There is dust everywhere, and I must get the furniture rubbed off as soon as possible, so run down and bring me my shoes from the closet under the stairs.

9. When I spent this afternoon driving nails in order to hang pictures I had no trouble because I used the very best saw to be bought at the hardware store.

10. When he awoke, sunshine flooded his bedroom. He threw back the clothes of the bed, and stealing towards the window he looked out. "How dark it is outside," he cried.

11. Frank had been expecting a letter from his brother for several days; so as soon as he found it on the kitchen table he ate it as quickly as possible.

12. A certain doctor living in a city near here always has a very serious expression on his face. This is perhaps because in his work he meets only well people.

13. When the automobile stopped the driver got out and found the tank was empty. Had he thought of it, he could easily have stopped and emptied it at the garage.

14. Going home on Sunday Susan passed the church from which the sound of organ music was coming. She noticed that many people went in to dance, rich and poor alike.

15. It was quite dark in the nursery; the children could see nothing. But their mother, as she tip-toed down the stairs heard Mary reading softly to her little sister.

16. This band of men and women set sail for the new world where they could live in peace. There was great rejoicing when their eyes first saw their new automobile.

17. A camel caravan was moving very slowly across the desert. Everyone was tired out from the long, hot journey and afraid that the supply of gasoline would not hold out.

18. A boy was sitting reading a most interesting book. He was very much disappointed to find that he could not finish because there were a number of the nails missing.

19. Of the lessons I have at school I enjoy handwriting most. Father says he can understand this since he and mother were very good singers when they were at school.

20. I had no money to pay my fare when I got on the trolley car today. When a friend loaned me a newspaper, you can imagine how pleased I was.

21. To get the food they needed the Indians hunted in the forest and shot with their bows and arrows. For this reason every little Indian boy was taught to dance.

22. Seeing a strange man climb through the window of my neighbor's house, I ran to my telephone because I wanted to ask the doctor to come as quickly as possible.

23. Give your friends your photograph for a gift because they can buy anything else you choose. So go to the grocery soon if your gift is not to be late.

24. Mr. Jones' furnace greatly needed to be repaired. As he wanted to have a good job done he came to enquire where the best automobile repair shop could be found.

25. Her only reason for being absent from school was that she attended a party, but this was not a good enough excuse for the teacher to be willing to refuse.

26. James' fountain pen went dry when he was doing his homework for school. He was very cross because until he got some more glue he could not continue his work.

27. The boys saw coming towards them an old woman, bent with sorrow, dressed in deepest black. They thought, turning from their play to watch her pass, how happy she looked.

28. On Sunday Mr. Jones never reads anything but good books for he is a very religious man. Each Sunday I see him reading the newspaper before he starts for church.

29. Johnny came walking into the parlor with very dirty shoes after playing all day. His mother sent him to clean his teeth and told him he was a bad boy.

30. The paper hangers and cleaners are working in our house and nobody likes it. Even though the men are careful, the house is easy to keep clean at such times.

Go on to the next column.

Score is number right. ☐

Printed in U. S. A.

International Typing Test No. 380

J. N. KIMBALL

	Strokes
I have sometimes felt a trifle out of patience with	52
Dame Nature on account of the indiscriminate manner	104
in which she hands out her favors, and because she has	159
seen fit to give to four-footed animals, to birds, and even	219
to insects, abilities that she has not given me and which	277
I could use to great advantage if I had them. In fact	332
there is not a creature in the world that is not better	388
fitted to take care of itself at birth than a human being.	448
Even the chicken frees itself from its shell and in a short	508
time can be seen following its mother as she scratches	563
the ground for its food. A colt ten days old is more than	622
the equal of a child a year old so far as perambulating	678
the earth is concerned, and in other ways as well.	730
Consider the seal. Here you have the most ungraceful	784
of all mammals but equally at home on land or in the	837
water. I once saw a seal that had been trained by a	890
showman, or rather one that had been taught to use its	945
talents at command. The man would toss it a large rub-	996
ber ball and the seal would catch it, not with his flippers	1056
but with his nose, balancing it perfectly and tossing it	1113
up and down, never making a misplay. I cannot do that.	1170
Think what a shortstop I would make for a baseball	1221
club if I could. I would be able to write my own con-	1274
tract and managers would fall over each other for a	1326
chance to sign it. And if I could swim and dive like a	1382
seal I could be a lifeguard at the seashore and maybe	1436
be decorated for saving the daughter of some magnate	1489
—it makes me cry.	1509
Consider the dog. I once had a puppy, some kind of	1561
a terrier but with nothing to boast of in the matter of	1617

Printed in U. S. A.

International Typing Test No. 381

J. N. KIMBALL

	Strokes
I could not have been more than seven or eight years	53
old when I was introduced to the art and practice of	106
calligraphy. What the word meant I did not know at the	162
time, in fact I am not certain now. My pocket diction-	216
ary says that it means handsome penmanship, but if that	272
is correct I never mastered the art, for my handwriting	328
never could be called handsome.	361
My introduction was made by means of a book ruled	408
with blue lines and at the top of each page was a line	463
of penmanship which I was supposed to copy, and which	517
at the same time contained something of ethical value	571
and was intended to improve my morals as well as my	623
handwriting. Whether it accomplished either result I	677
leave to others to decide.	705
One of those lines asked what the bee did in the sun-	757
shiny hours and on the next page answered the question	815
by stating that it gathered honey. If all this had no	867
other effect upon me it did lead me to have an interest	923
in Brother Bee and I have made something of a study	975
of him and do not consider the time wasted.	1020
He has been termed "busy," and it fits him like a	1070
glove. He labors from sunrise to sunset on every plea-	1124
sant day and never takes a vacation. Of course he lays	1180
off during the winter but it is only because he is obliged	1239
to do so. He is a whole labor organization in himself,	1295
but he never goes on a strike and seems perfectly satis-	1350
fied with his wages. The only fault I can find with him	1407
is that he is somewhat of a socialist.	1447

Printed in U. S. A.

International Typing Test No. 381

J. N. KIMBALL

	Strokes
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time, in fact I am not certain now. My pocket diction-	216
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glove. He labors from sunrise to sunset on every plea-	1124
sant day and never takes a vacation. Of course he lays	1180
off during the winter but it is only because he is obliged	1239
to do so. He is a whole labor organization in himself,	1295
but he never goes on a strike and seems perfectly satis-	1350
fied with his wages. The only fault I can find with him	1407
is that he is somewhat of a socialist.	1447

Strokes

He certainly has one faculty which I would like to 1498
possess—that of finding his way home. I have often 1551
lived in a hotel in Boston, and wanting a daily paper I 1607
would wander about until I found a news stand, only to 1662
find that I was utterly lost so far as reaching my hotel 1719
again. Of course this happens to every stranger in Bos- 1774
ton, but if I were a bee it would never happen to me. 1829
When he is through with the matter he has on hand 1879
and wants to go home he does it, not by meandering 1930
about or asking a policeman, but by a faculty which 1982
neither you nor I possess. 2010

If you wish to prove it you can do so easily and at the 2066
same time acquire a store of wild honey. Get a small 2120
box, say five or six inches square, and for a cover use a 2178
piece of glass. Place a lump of honey in the box and go 2235
to the nearest clover bed and capture a bee by placing 2290
the box under him and forcing him in with the glass 2342
cover. 2350

He will be very angry about it as you can tell from the 2406
language he uses, but bye and bye he sees the honey and 2462
changes his mind. He never gives a thought to his 2513
means of escape. He has run across a gold mine and it 2568
is up to him to work it. You and I would do the same 2622
thing under similar circumstances—at any rate I would 2677
like to be put to the test. 2706

Brother Bee fills up with honey, then he walks up the 2759
side of the box, cleans his wings with his feet and be- 2813
gins to think about home. You can now take your cover 2868
off, in fact you may do so the instant he discovers the 2924
honey for he will not attempt to leave until he has sam- 2979
pled the lode. Finding his way clear he now rises slowly 3037
because he has a heavy load, circles once or twice about 3094
your head as if to get his bearings, and then starts for 3151
home as straight as though fired from a rifle. If you 3206

Strokes

could aim directly after him when he has gone a hun- 3257
dred feet your bullet would find its way to the hive 3310
where he lives. 3327

You may believe you have said good bye to him but 3377
if so you are mistaken. If you will be patient for a few 3435
minutes you will find him buzzing about your head look- 3489
ing for his gold mine. If you have left it on the ground, 3548
on a stone or stump, he will spy it and start loading up. 3607
This takes him but little time and again he starts for 3662
home, this time without making preliminary circles. 3715
If you want to find the hive you now walk along the 3767
line he has taken as far as your eye was able to follow 3823
him and put your box down again. You need not fear 3875
that he will not discover it for he has taken a photo- 3928
graph of you and would know you anywhere. 3971

He will be back again shortly, and here is something 4024
peculiar—he will bring a companion with him. I have 4078
often wondered how it was possible for him to tell his 4133
friend what he had discovered, but he does it and both 4188
he and his pal load up and depart. Then again you 4239
follow as far as you are able to trace him, put down your 4297
box and wait for customers. They will come and this 4350
time there will be four or five of them and the number 4405
will increase as you approach the hive. 4446

But always they will come and go in a perfectly 4494
straight line, if necessary, over woods or hills, never 4550
for a moment deviating from the direct road or hesitat- 4604
ing as if trying to decide which way to go. It is that fac- 4663
ulty that is a marvel to me. I have been lost in the 4717
woods and without the slightest idea as to my way home 4772
—that could not happen to Brother Bee. And he has an 4827
excellent memory, too. If you find his hive and take 4881
away his store of honey and are in the vicinity a week 4936

123456789 123456789 123456789 123456789 123456789 123456

	Strokes
later you will hear him buzzing about your head—not	4989
with any desire to avenge the robbery of his hive, but	5044
evidently because he believes you may have another	5095
gold mine concealed about you. I have had them follow	5150
me about for a long time after I had discovered the hol-	5205
low tree in which they lived and extracted all the con-	5259
tents of the hive.	5279
And that makes me remember that they choose all	5327
sorts of places. I once visited the abandoned home of	5382
a tribe of cliff dwellers in Arizona, a place that had not	5441
been used for a dwelling for more than a thousand	5491
years. It was a natural cave in the side of a hill and	5547
the bees had chosen the interstices in the ceiling, just	5604
holes in the primeval rock, for a place in which to de-	5658
posit their honey, and they had filled it so full that the	5717
honey was dripping to the floor.	5751
As for my lesson in calligraphy, well, it led me to	5803
study the bee and to get a good deal of useful knowl-	5854
edge out of him.	5871

(If completed before time is called start again from the beginning.)

One Minute

Something like two hundred years ago a poet was	48
born in England—his name was Wolcot. That is about	101
all I know of him. I have never seen his book—if, in-	155
deed, he published his rhymes. Poets in those days had	211
a habit of toting their stuff about in their pockets and	268
reading it to prospective customers. However, he con-	321
tributed two lines to English literature that it might be	379
wise for you to memorize: "Care to our coffin adds a	433
nail, no doubt, and every grin so merry draws one out."	488

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International Typing Test No. 382

J. N. KIMBALL

	Strokes
"Old Grimes is dead, that good old man, we ne'er shall see him more. He used to wear an old gray coat, all buttoned down before."	49 105 132
From where I sit I can gaze out upon a vast expanse of ocean, a complete half circle of water. There must have been a storm out at sea, because the surf is very high and comes racing up the bank with terrific force, not a hundred feet away. I cannot help dwelling upon the thought that there is no house, no fence, not a tree, between me and the most terrible war the world has ever known—there is only this strip of blue water. Perhaps if I put my ear to the ground I can hear the reverberation of the terrible conflict.	184 239 294 349 403 461 512 569 624 660
And then Old Grimes obtrudes himself without my permission or invitation. I wonder why. I never knew him and whether he is dead or alive is of no interest to me, nor is the fact that his coat was fastened with buttons. No item concerning him is of the least importance so far as I am concerned and the fact that I shall not see him is rather pleasing. It is more than seventy years since I heard or read that nonsensical jingle—why does it come back to me now?	708 763 820 875 932 987 1046 1102 1127
The answer is easy, of course; it is one of the fantastical tricks played by memory, the kind that it plays upon every human being now and then. Usually there is some connecting link, however far-fetched, but what Old Grimes has to do with the ocean, or with the blight and desolation of war is beyond my ken.	1181 1235 1287 1342 1398 1439
Scientists tell me that I have concealed beneath my hat a bunch of gray matter, scarcely bigger than my	1491 1543

fist; that it is made up of tiny cells in which I deposit the day's record—everything that happens to me everything I do. Size does not count. It is a vast filing case and as a general thing is so well indexed that I can instantly produce any item desired. But how does it work? That is something that the scientists cannot tell me. 1595 1648 1708 1766 1819 1876 1881

When I was something like fifteen years old I ran across a book belonging to my mother. I can bring it out of my brain and see it now, bound in red morocco and with the title in gold on the outside, but try as I will I cannot read that title. It was a book of poems and I am not at all certain as to the author. But one of the poems was "The Dream of Eugene Aram," and for some reason it took my fancy. I do not know what became of the book, but I can repeat that poem, word for word, in its entirety, but not a single line of anything else in that book. I am sure I did not memorize it purposely but how was it tucked away in my brain case? It is a riddle I cannot answer, nor can you. 1931 1985 2038 2094 2149 2207 2257 2309 2364 2421 2476 2529 2575

I believe memory is the most valuable faculty possessed by man, and at the same time the most neglected. I think the time will come when it will be carefully studied and made one of the main items in the curricula of our schools. If proper attention were given to it the result would be amazing. 2624 2671 2728 2780 2838 2874

There have been those who made a study of memory and became proficient in its use. The story is told of a poet who importuned the King of France to allow him to read his latest production. It happened at the same time that a memory fiend asked permission to display his skill to the king, and the latter told him that the poet would read his poem that afternoon and that he, the memory man, might hide behind a curtain and 2923 2979 3029 3084 3137 3194 3247 3299

see what kind of a job he could make of it. When the poet had finished the king accused him of plagiarism, that he had tried to foist some old stuff on him, and that he had somebody present who could repeat the verses word for word. In fact that was done and the poet was so angry that he tore up his manuscript and threw it out of the window. Being pacified by the king he acknowledged that he could not, himself, remember his poem and he only regained a copy by having Mr. Memory again repeat it. 3353 3407 3466 3518 3573 3630 3683 3735 3784 3802

I do not know how much of truth there is in the story but that is something that is absolutely possible I do believe and that any ordinary child could be so trained that he could read the text book on any subject and then throw the book aside with a perfect and enduring knowledge of its contents. 3856 3911 3967 4019 4073 4101

But memory has other tricks in its bag. I once had a friend, now long since dead. A few days ago a chance conversation turned on a subject in which my friend had been interested and I said to the person with whom I was talking, "Did you know Mr. ——?" and then I stopped. Try as I might I could not recall my friend's name. I could see him plainly in my mind's eye, I could recollect everything he and I had done—everything was perfect except that I had forgotten his name. "Forgotten" is not the right word, however. I have that name carefully stowed away in my brain case and one day I will discover it when I am searching for something else. I am certain of it for I have had similar experiences many times. 4155 4209 4261 4316 4365 4421 4478 4533 4587 4642 4695 4753 4807 4820

I do not think we really ever forget anything we simply mislay it. When we miss a collar button we say it is "lost." But that is not correct. We know that it is somewhere about the premises and that one day we will 4873 4928 4985 5039

	Strokes
discover it. It is like that with everything recorded by	5097
memory and a forgotten fact will bob up serenely when	5151
least expected and when all desire to regain it has been	5208
cast aside.	5221
The medical profession has reached the point where	5272
it can tell you the use of about every part of the human	5329
body save the appendix, maybe, and they simply ignore	5383
that and when it gets to be a nuisance cut it out. They	5440
can tell you where the different parts of the brain are	5496
situated and what nerves are operated by them, but	5547
they cannot tell how the items of our daily life are	5600
stored away in the tiny cells of the brain, nor how we	5655
can reach in and get any one of them without the slight-	5710
est difficulty. I doubt if human knowledge will ever	5764
extend that far.	5782
I confess I would give much to understand it all but	5835
it is too deep for any diving I can do, and all the time I	5894
remember that Old Grimes is dead and we shall see	5944
nothing more of him—I hope not, at any rate.	5989

(If completed before time is called start again from the beginning.)

One Minute

As between the optimist and the pessimist I put my	51
money on the optimist, every time. No man is beaten	104
who is able to smile and trust to better luck next time.	162
The pessimist is always worrying about the dark spots	216
in the picture—the optimist at once sets about bright-	270
ening them. He may be "down," but he is never "out."	325
He is like the fellow who had the misfortune to fall from	383
the roof of a twenty-story building and as he passed	436
the tenth floor was heard to say, "I am all right so far."	494

OFFICIAL INTERNATIONAL CONTEST RULES FOR CORRECTING TYPING TESTS

J. N. Kimball, 453 East 141st Street, New York, N. Y.

1. LINE SPACING. Work must be double spaced--"two notches." Every line singly or irregularly spaced is penalized one error in addition to all other errors in same line.

2. LENGTH OF LINE. Except at end of paragraph, any line having fewer than 61 or more than 76 characters and spaces is penalized one error in addition to all other errors in same line.

3. LENGTH OF PAGE. With paper 8 1/2" by 13", each page, except the last, must have at least 35 lines of writing; with paper 8 1/2" by 11", each page, except the last, must have at least 29 lines of writing. One error is charged for short page--not one error for each line that the page is short.

4. PARAGRAPHING. Paragraphs must be indented five spaces, and only five. An error in paragraphing is penalized in addition to all other errors in same line.

5. SPACES AND PUNCTUATION POINTS. Spaces and punctuation points are treated as parts of the preceding word, but if incorrectly made, inserted, omitted, or in any manner changed from the printed copy, an error must be charged unless the preceding word has already been penalized. (See Rule No. 6.)

6. SPACING AFTER PUNCTUATION. Two spaces must follow the period, the colon, the interrogation, and the exclamation points--one space only after all other punctuation points.

   If punctuation is followed by quotation marks the spacing follows the rule laid down for the punctuation point, viz., a colon followed by quotation marks calls for two spaces, but a comma followed by quotation marks calls for but one space. (See Rule No. 5.)

   After a period used to denote abbreviation, as O. K., M. D., Mr., Mrs., initials, etc., the spacing required is that which would be used if word was written out in full, viz., one space, unless the abbreviation ends a sentence.

7. A DASH must be written with two hyphens without spacing before or after. If a dash is necessary at the beginning of a line there should be no space between it and the following word.

8. CUT CHARACTERS. Any word written so close to top, bottom, or side of sheet, that a portion of any letter is cut off, must be penalized.

9. WORDS WRONGLY DIVIDED. A word wrongly divided at the end of a line must be penalized. A word hyphenated at the end of a line

in the printed copy may or may not need the hyphen if occurring medially in the contestant's work. For instance: "Devilfish" might be hyphenated at the end of a printed line, but medially, if contestant's rendering conforms to any standard dictionary, there is no error.

10. FAULTY SHIFTING. An error must be charged against every word where the shift key is incorrectly used. If the complete character is discernible it is no error.

11. LIGHTLY STRUCK LETTERS. If the outline of any character is discernible there is no error.

12. TRANSPOSITION. Letters transposed in any word constitute an error. Words when transposed are penalized one error for the transposition, and for every error in the transposed words.

13. REWRITTEN MATTER. In rewritten matter every error must be penalized, whether in first or second writing, and one additional error charged for the rewriting.

14. CROWDING. No word shall occupy less than its proper number of spaces.

15. PILING. If any portion of the body of one character overlaps any portion of the body of another character, or extends into the space between words to the extent that it would overlap any portion of the body of a character were there a character in that space, then it is an error.

16. LEFT-HAND MARGIN. Characters beginning lines, except in paragraphs, must all be struck at the same point of the scale. If printed to the left or right of that point an error must be charged.

17. X-ING. Work in which words are x-ed will not be received.

18. ERASING. The use of an eraser is not allowed.

19. ERRORS IN PRINTED COPY. Errors found in the printed copy may be corrected or written as per copy, but in no case shall an error be charged against such words unless they are omitted.

20. LAST WORD. An error made in the last word written, whether that word is completed or not, must be charged.

21. PENALTY. For every error 10 words are to be deducted.

22. GENERAL RULE. Every word omitted, inserted, misspelled, or in any manner changed from the printed copy (save in the case of transposition and rewritten matter), must be penalized.

23. GROSS WORDS. The gross number of strokes shall be reckoned from the printed copy of matter used, and shall be divided by five, the

result being the number of gross words from which all deductions for errors shall be made. Strokes in rewritten matter are not to be counted in the gross. When a typist ends his test with an unfinished word, he shall be given credit of one stroke for each character written.

Copy should have the gross strokes printed at the end of each line, the strokes being counted per line of print, with an additional stroke at the end of each line--if the last word on that line is completed (not hyphenated). In other words, the strokes are counted as though the entire test were written in one continuous line.

Beginning a paragraph, the count commences with the first letter of that line, as actual strokes made for characters and spaces only are counted. Extra strokes made by the typist when shifting for capital letters, when paragraphing and when returning the carriage, are not counted.

In counting strokes from printed copy two strokes are given to every dash in the printed copy, and to all spaces after the colon, interrogation and exclamation points and period.

If necessary to strike a second key to complete a character--as the exclamation point, and accented letter occurring in some foreign languages--the extra stroke is counted.

TEST SCORES FOR SCHOOL 1

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
1	30	27									
2	27	27									
3	26	26	42	44	43	0	1	8	0	1	10
4	26	26	42	43	44	4	7	1	6	7	4
5	26	26	40	34	37	2	0	3	3	1	4
6	26	25	43	40	42	1	4	2	1	5	3
7	26	26	29	34	35	6	8	8	6	18	10
8	26	26	32	34	32	3	2	5	4	4	7
9	24	24	35	37	40	1	2	5	2	2	6
10	24	24	44		46	3		0	3		2
11	24	24	37	37	37	4	5	5	4	7	5
12	24	23	30	27	30	2	4	2	5	8	3
13	23	23									
14	23	23	35	39	37	4	4	7	6	8	10
15	23	21	46	42	45	6	2	5	6	4	5
16	22	22	37	38	42	4	2	3	4	4	4
17	22	20	25	31	31	5	5	8	6	5	10
18	22	22									
19	22	21	33	35	37	4	0	2	5	0	6
20	22	22	35	30	34	2	6	0	3	9	1

TEST SCORES FOR SCHOOL 1 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
21	21	19	45	47	47	4	5	6	7	6	12
22	21	21	39	39	37	3	1	2	3	1	3
23	21	21	23		40	0		2	0		2
24	21	18	47	44	41	3	5	4	5	7	7
25	21	21	39	40	48	4	1	3	4	5	5
26	21	21	36	35	39	2	1	2	2	4	2
27	21	21	45	49	47	1	3	2	1	5	12
28	21	20	42	39	43	11	12	7	20	18	11
29	19	19	38	38	37	0	2	3	0	2	3
30	19	19	29	32	30	0	2	8	0	3	10
31	19	19	42	45	38	0	6	6	0	6	8
32	19	17	34	32	37	1	5	0	2	9	4
33	19	17	36	37		3	4		4	4	
34	18	18	28	41	39	4	1	3	6	2	3
35	18	18	34	46	45	3	16	4	9	28	10
36	18	17									
37	18	18	40	39	40	2	3	2	3	3	2
38	18	17	34	35	37	0	0	1	0	0	2
39	18	18									
40	18	18	33	33	33	3	2	1	4	2	1

TEST SCORES FOR SCHOOL 1 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
41	17	17	43		39	9		4	11		6
42	17	16	32	33	37	6	1	9	6	2	13
43	16	16	43	44	43	1	3	4	1	5	8
44	16	15	36	34	28	8	9	8	14	14	9
45	16	16	45	45	44	7	2	6	7	7	7
46	16	16	42	34		4	3		14	4	
47	15	15									
48	15	15	31	30	37	4	5	3	4	6	3
49	15	15	31	29	29	3	3	5	5	3	6
50	15	15	35	54	37	2	11	3	4	17	3
51	15	12	36			7			20		
52	14	14	37		41	5		0	9		0
53	14	14									
54	14	12	39	42		2	5		3	5	
55	13	13	26	34	35	14	4	2	15	4	3
56	13	4	46	39	40	6	7	10	9	7	24
57	12	12	33	41	35	4	11	1	7	19	3
58	11	10		30	29		5	5		8	8
59	11	11	41	39	41	4	3	4	4	5	6
60	11	11	29	39	36	5	5	3	6	7	4

TEST SCORES FOR SCHOOL 1 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
61	11	10	43	44	43	1	4	3	2	5	4
62	10	9	38	35		8	10		19	13	
63	10	9									
64	9	8	25	31	29	6	2	2	7	5	3
65	7	4	29	31	29	7	6	3	8	7	3

TEST SCORES FOR SCHOOL 2

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
1	27	27	35	32	35	12	9	4	13	11	6
2	26	26	39	32	38	6	1	6	7	4	8
3	25	23									
4	24	24	27	26	30	3	4	1	4	5	2
5	21	21									
6	21	21	42	41		11	17		20	55	
7	20	20	28	30	29	14	15	12	19	17	13
8	20	20	33	34	35	3	5	2	4	6	3
9	19	19	39	41	37	8	10	10	12	18	19
10	19	19	35	37	38	4	6	4	4	7	9
11	19	18	29	31	36	3	4	3	4	5	5
12	19	18	39	40	47	6	6	6	6	18	6
13	19	17	39	43	35	10	9	7	13	11	10
14	18	18	30	34	32	4	6	1	4	8	4
15	18	18									
16	18	17									
17	18	17	34	38	37	3	7	2	5	11	8
18	18	17	31	35	33	4	6	4	9	6	6
19	17	17	35	33	38	4	2	1	4	2	2
20	17	17	30	34	30	5	5	2	5	7	3

TEST SCORES FOR SCHOOL 2 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
21	17	17	37	41	39	7	9	8	17	12	10
22	17	17									
23	17	17	39	43	36	7	2	0	7	3	2
24	17	16	35	35	37	5	5	2	6	7	4
25	17	16									
26	17	16	34	34	35	2	2	4	8	3	6
27	16	16	24	22	22	5	8	4	6	11	7
28	16	16	37	35	33	10	9	14	14	13	33
29	16	15	29		33	3		7	5		8
30	16	15	38	40	43	4	7	2	6	7	3
31	16	15	26	30		4	7		4	9	
32	16	15	20	28	29	3	1	2	3	1	2
33	15	15	34	42	37	0	3	6	4	5	21
34	15	15	29	28	28	11	4	3	20	7	3
35	15	15	37	31	32	1	1	0	4	4	0
36	15	15	46	40	42	17	7	1	20	12	4
37	15	15	32	36	34	0	3	1	0	4	2
38	15	15	35	35	38	6	5	3	19	9	5
39	15	15									
40	15	15	26	25		5	3		10	4	

TEST SCORES FOR SCHOOL 2 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
61	13	12	30	24	28	4	2	4	6	8	11
62	12	11	35	36	39	8	11	7	9	19	15
63	11	8	34	35	36	5	8	0	5	11	2
64	10	10	29	27	33	5	3	4	7	4	5
65	10	9									
66	10	6	35	33	34	4	4	4	7	9	6
67	8	8	28	31	33	13	12	12	15	14	15
68	6	2									

TEST SCORES FOR SCHOOL 3

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
1	29	29									
2	24	24	43	45	46	4	3	7	5	5	9
3	23	23	22	23	27	4	4	5	4	5	6
4	23	23	40	40	36	3	4	4	6	14	9
5	23	21	46	47	49	1	6	6	1	8	13
6	23	23	46	46	49	5	5	5	7	6	9
7	22	22	39	36	39	4	12	8	4	16	8
8	22	22	42	39	44	0	1	1	1	1	3
9	22	22	36	40		11	12		11	13	
10	22	22	43	46	42	6	6	10	7	9	11
11	21	21	27		28	13		1	15		4
12	20	20	38	43	44	1	12	7	1	13	9
13	19	19		38	39		0	2		0	5
14	19	19	35	36	38	7	9	11	10	11	17
15	19	19			34			6			12
16	19	18	20	22	22	7	13	15	21	19	24
17	19	13	31	34	35	2	6	5	3	7	18
18	18	18	37		42	4		2	9		6
19	18	18	38		38	3		12	4		17
20	18	18	46	44	49	7	5	6	12	7	10

TEST SCORES FOR SCHOOL 3 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
21	18	18	29	32	30	2	2	3	7	5	5
22	18	18	34	36	35	10	7	3	11	7	5
23	16	16	26	28	29	5	13	5	5	14	9
24	16	16	32	35	35	6	11	2	8	13	9
25	16	16									
26	16	16	44	46	44	4	4	5	6	5	6
27	16	15	20	24	24	2	4	1	8	8	5
28	15	15	34	41	44	0	0	2	0	1	2
29	15	15	26	27	28	3	1	6	8	5	7
30	15	15	40	42	40	5	8	10	9	13	12
31	15	15	27		29	7		1	7		2
32	15	15									
33	14	14									
34	14	14	32	36		2	8		3	10	
35	14	14	25	30	32	2	2	2	5	2	5
36	14	14	29		32	2		2	4		6
37	14	14			31			2			4
38	14	13	41	43	45	4	3	6	4	7	15
39	14	13		26	31		7	5		7	6
40	13	13	23	31	31	5	5	3	9	10	8

TEST SCORES FOR SCHOOL 3 (continued)

Pupil No.	Reading		Typewriting								
			Gross Words			Reading Errors			Total Errors		
	Rate	Comprehension	Test			Test			Test		
			1	2	3	1	2	3	1	2	3
41	13	10	49	43	48	5	3	4	9	4	7
42	12	12	35	42	37	6	4	4	6	4	17
43	9	9	25	26	28	4	3	3	7	7	5
44	9	9									
45	9	8		34			5			10	
46	6	3	17	19	22	6	1	4	25	2	7